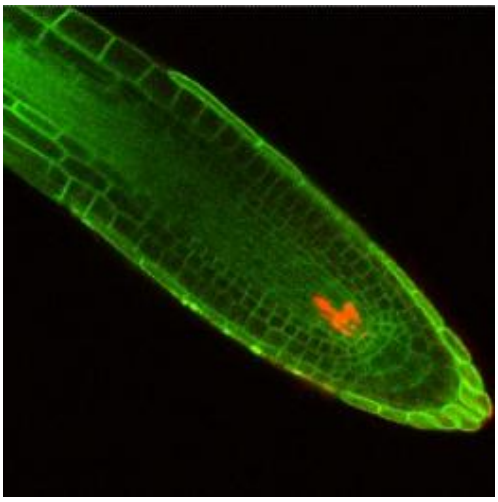
Protecting the future: How plant stem cells guard against genetic damage



This is a confocal laser scanning micrograph of an Arabidopsis root tip in which the cell outlines are marked in green by a fluorescent protein.
The orange region marks stem cells that died after treatment with a drug that damages DNA. Credit: John Innes Centre

Scientists at the John Innes Centre in Norwich, UK, have shown how plants can protect themselves against genetic damage caused by environmental stresses. The growing tips of plant roots and shoots have an in-built mechanism that, if it detects damage to the DNA, causes the cell to 'commit suicide' rather than pass on its defective DNA.

Plants have, at the very tips of their roots and shoots, small populations of stem cells, through which they are able to grow and produce new tissue throughout the plant's life. These stem cells are the precursors to producing plant tissues and organs. This means that any defect that arises in the stem cell's genetic code will be passed on and persist irreversibly throughout the life of the plant, which may last thousands of years.

It is therefore critical that there are safeguards that prevent stem cell defects becoming fixed, particularly as the stem cells exist at the growing tips of shoots and roots where they are especially exposed to potentially hazardous environments.

Nick Fulcher and Robert Sablowski, with funding from the Biotechnology and Biological Sciences Research Council (BBSRC), set out to discover what these safeguards could be. By using X-rays and chemicals they were able to induce damage to DNA, and found that stem cells were much more sensitive to DNA damage than other cells. The cells are able to detect the DNA damage, triggering the death of these cells, thus preventing the damaged genetic code becoming fixed in the rest of the plant tissues.

A similar system exists in animal cells, which has been very well investigated, as the failure of this system can lead to cancer. The discovery of a similar, although distinct system in plants is therefore of great interest in the field of plant development, as well as in the efforts of scientists to develop plants better able to cope with environmental stress. Drought, high salinity and the accumulation of hazardous chemicals in the soil are side-effects of a changing climate, so knowledge of how plants cope with theses stresses is of fundamental importance to agricultural science's response to climate change. This is one aim of the research carried out by the John Innes Centre, an institute of the BBSRC.

Source: Norwich BioScience Institutes

"Protecting the future: How plant stem cells guard against genetic damage." Phys.org. 16 Nov 2009.
http://phys.org/news177609128.html